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(54) Title of the invention: Antistatic agent for polyester resin

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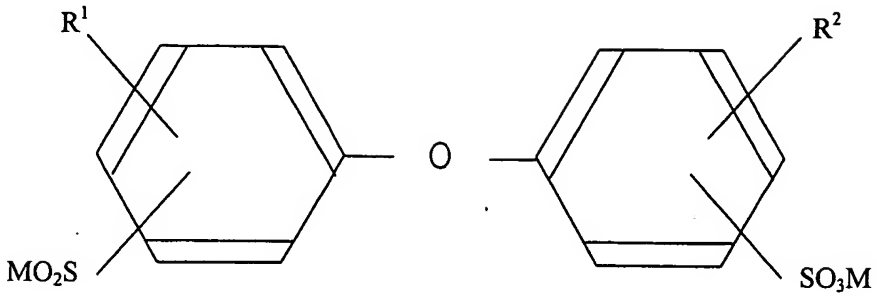
1. Title of the invention

Antistatic agent for polyester resin.

2. Scope of the patent

An antistatic agent for polyester resin having the compounds shown in the general formula as the main ingredients.

(I) ***General formula***



(In this form, R^1 is 4-22C alkyl, R^2 is H or 4-22C alkyl and M is alkali metal ion or ammonium ion).

3. Detailed description of the invention

Fields of industrial usage

This invention is concerned with a new antistatic agent for polyester resin. To mention in detail, this invention is concerned with an integrated antistatic agent for polyester resin, especially for polyester films, capable of imparting excellent antistaticity to a resin without lowering its transparency.

Conventional techniques

The polyester film is generally known to have a high melting point and high crystallization and because of its excellent properties such as dimensional stability, strength, chemical resistance, weather resistance etc. it has been extensively used in magnetic recording tapes, metallized bases, electric and electronic parts material, packaging material, (print) plate making etc.

Since the polyester film gets electrically charged easily, care must be taken during its manufacture to see that trouble does not arise too often; dust does not adhere to the product marring the beautiful view etc.

In order to do away with such shortcomings, till now methods such as applying a coat of a suitable antistatic agent on the surface of the film or blending the film internally were adopted. However, in the former method of coating the film with an antistatic agent, there is a problem of the antistatic agent easily disappearing through washing or friction and therefore it is difficult to make the effect last.

As against this, in the latter method of blending the film internally, it is possible to make an excellent antistatic agent adhere lastingly and is therefore said to be a preferred method. In this method, till now alkyl sodium sulfonic acid, alkyl allyl sodium sulfonic acid, polyethylene glycol, quaternary ammonium salt etc. have been used as antistatic agents. However, such antistatic agents lower the transparency of the film; in other words, since the antistatic effect is not enough, it is necessary to use these agents in larger quantity as a result of which the quality of the film suffers, which is the drawback in this method.

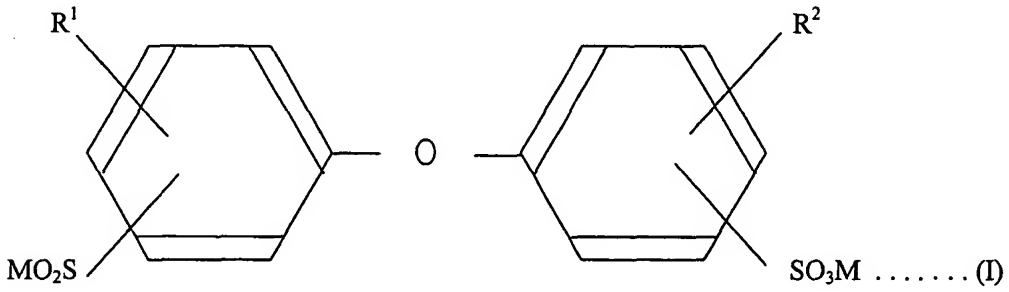
The problems that this invention seeks to solve

This invention seeks to do away with the drawbacks in the conventional integral antistatic agent for polyester resin and to provide an integrated antistatic agent, especially for polyester films, capable of imparting excellent antistaticity to a resin without lowering its transparency.

Procedure for solving these problems

As a result of the tireless research carried out by the inventors to develop an integral antistatic agent for polyester resin having the desired characteristics mentioned above, an alkyl diphenylether disulfonic acid having a specific configuration and compatible with the target compound was discovered and based on this knowledge this invention could be completed.

In other words, this invention provides an antistatic agent for polyester resin with the compounds shown in the general formula as the main ingredient



..... (I)

(In this form, R^1 is 4-22C alkyl, R^2 is H or 4-22C alkyl and M is alkali metal ion or ammonium ion).

This invention is explained below in detail.

In this invention, the compound which is used as the main ingredient in the antistatic agent, is alkyl diphenylether disulfonic acid shown in the General formula (I) in which the alkyl-group can be bonded on one side or both sides of the respective benzene rings and the bonding position of the alkyl-group with respect to the oxygen atom could be any of o-position, m-position or p-position. The alkyl-group is the one which has a carbon quantity in the range of 4 ~ 22, for example butyl-group, pentyl-group, hexyl-group, heptyl-group, octyl-group, nonyl-group, decyl-group, undecyl-group, dodecyl-group, tridecyl-group, tetradecyl-group, pentadecyl-group, hexadecyl-group, heptadecyl-group, octadecyl-group, nonadecyl-group, eicosyl-group etc. These alkyl-groups could be in the linear form or be of the branched-chain type.

Further, there is no particular limitation with regard to the position of the sulfonic acid group that is bonded with the respective benzene ring in the said compound. In the case of oxygen atom, any of o-position, m-position of p-position will do.

In the compounds shown in the general formula (I) earlier, alkali metal ions such as sodium ion, potassium ion, lithium ion etc. as well as ammonium ion are the cations, which constitute the sulfonic acid.

The compounds shown in the General formula (I) above can be produced through the methods mentioned in the conventional techniques or any commercially available product that can be easily procured, can be used.

The antistatic agent in this invention can be used singly or as a combination of two or more compounds from the General formula (I) shown above. Further, as per one's desire, other antistatic agents may also be used without losing out on the objective of this invention.

The antistatic agent in this invention is the integral type and normally a combination of 0.1 ~ 5 weight %, preferably 0.5 ~ 2 weight % is used for polyester resins. If this quantity is below 0.1 weight %, then the bonding effect of the antistatic agent will not be sufficient and if it exceeds 5 weight %, then it is seen that there is no appreciable progress in the effect with the increase in ratio, rather, there is a decline in the quality of the polyester resin.

There is no particular restriction on the method of integrating the antistatic agent to the polyester resin in this invention. The method that has been used until now to blend the integrated antistatic agent to the polyester resin can be used in this invention also.

To enable the antistatic agent to obtain a film from the integrated polyester resin, it is processed through known methods such as extrusion (T-die method, expansion method etc.), calendaring, casting etc. and further to this it would be desirable to process it through a uniaxial or diaxial drawing, as one may choose. The thickness of the film is suitably selected keeping in mind its purpose of usage and it is normally in the range of 3 ~ 400μm.

Application examples

The present invention is explained below in detail through application examples. The invention, however, is not restricted only to these examples.

Application example 1

Polyethylene terephthalate was produced through the usual method and the polyester chip was molded using an extruder.

Next, 100 parts weight of the chip which had been sufficiently dried, and 1 part weight of dodecyl diphenylether sodium disulfonic acid was kneaded through an extruder and after fusing and extruding, biaxial drawing was done and a drawing film of 60μm thickness was prepared. The surface resistance value and haze value of this film was obtained, the results of which are shown in Table No.1.

Application example 2

In application example 2, a process similar to that in application example 1 was carried out, a drawing film was prepared and the results evaluated, the only difference here being that a mixture of 0.5 weight part of dodecyl diphenylether sodium disulfonic acid and 0.5 weight part of dodecyl benzene sodium sulfonic acid were used as antistatic agents. The results of this process are shown in table no.1.

Comparison example 1

Here, a process similar to that in application example 1 was carried out, a drawing film was prepared and the results evaluated, the only difference here being that dodecyl benzene sodium

sulfonic acid was used instead of dodecyl diphenylether sodium disulfonic acid. The results of the process are shown in table no. 1.

Comparison example 2

Here, a process similar to that in application example 1 was carried out, a drawing film was prepared and the results evaluated, the only difference here being that dodecyl sodium sulfonic acid was used instead of dodecyl diphenylether sodium disulfonic acid. The results of the process are shown in table no. 1.

Comparison example 3

Here, a process similar to that in application example 1 was carried out, a drawing film was prepared and the results evaluated, the only difference here being that a mixture of mixture of 0.5 weight part of dodecyl sodium disulfonic acid and 0.5 weight part of polyethylene glycol were used as antistatic agents. The results of the process are shown in table no. 1.

Table No. 1

	Surface resistance value [1] (Ω)	**Haze value [2] (%)**
Application example 1		
Application example 2		
Comparison example 1		
Comparison example 2		
Comparison example 3		

Note:

1) Surface resistance value:
   Using a static onestometer, the surface resistance value was measured under a supply voltage of 1000 V, temperature of 20°C and a humidity of 65%.
2) Haze value:
   The haze value was obtained in conformity to JIS K-6714 standard.

Effect of this invention

The antistatic agent for polyester resin in this invention is an integrated compound, which has an alkyl diphenylether disulfonic acid with a specific structure, as the main ingredient and it has the capability to impart excellent antistaticity to a resin without lowering its transparency, especially for a polyester film.